DOCUMENT RESUME

ED 306 103 SE 050 501

AUTHOR Furuness, Linda Bishop; Cohen, Michael R.
TITLE Children's Conceptions of the Seasons: A Comparison of Three Interview Techniques.
PUB DATE 89
NOTE 11p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (62nd, San Francisco, CA, March 30-April 1, 1989).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Cultural Influences; Elementary Education; *Elementary School Science; *Field Studies; *Interviews; *Qualitative Research; *Research Methodology; Science Education; Social Science Research
IDENTIFIERS Science Education Research

ABSTRACT

A great deal of work has been accomplished over the past several years on children's conceptualizations of various scientific phenomena. A problem, however, is determining whether one's collection techniques provide a complete picture. In this study three techniques (the repertory grid, draw and describe, and the interview about events) were used to collect information on children's concepts of the seasons. Twenty-four fourth graders were included in this study. Eight children were interviewed using this technique. The relationship of "life-world knowledge" and "scientific knowledge" was critical in this study since seasons can be approached from the direction of scientific explanations or cultural events and celebrations. The results of this study indicated that the repertory grid technique provided more of a science knowledge view, the draw and describe technique provided more of a cultural view, and the interview about events technique corresponded well with both the cultural and scientific views. The results suggest a relationship between school science and school social studies and may support the current Science-Technology-Society emphasis. (CW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED306103

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Linda Furuness

Michael Cohen

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Children's Conceptions of the Seasons: A Comparison of Three Interview Techniques

Linda Bishop Furuness

and

Michael R. Cohen

Indiana University
School of Education
902 West New York Street
Indianapolis, Indiana 46223

Paper presented
at the
Annual Meeting
of the
National Association for Research in Science Teaching
San Francisco, Ca., April 1, 1989

SE 050 501

Children's Conceptions of the Seasons:
A Comparison of Three Interview Techniques

Linda Bishop Furuness and Michael R. Cohen

Introduction

A great deal of work has been accomplished over the last ten or so years on children's conceptualizations of various scientific phenomena (Driver and Easley, 1978; Driver and Erickson, 1983; Gilbert and Watts, 1983; Osborne and Freyberg, 1983). Throughout all of these studies, it has become apparent that children commonly develop various notions in attempting to understand science concepts, (Ault, 1983; Helm, 1980; Cohen and Kagan, 1979; Driver and Easley, 1978; Gilbert, Osborne and Fensham, 1982; Novak, 1977). While the explication of children's science concepts has become a valued area of research in science education, it has also spawned new research agendas and approaches (Novak, 1988). This paper will add to the knowledge base of children's science concepts (about seasons) and at the same time clarify "new ways to make records of the events...," (Novak, 1988).

Children's Views of the Earth in Space

Children at an early age notice that the sun appears to rise in the morning, move across the sky during the day, and set in the evening. The earth, from the standpoint of their senses, does not move. Elementary school curricula include the teaching of the earth as a very large spherical body which rotates on its axis resulting in day and night, and travels in an orbit around the sun, creating seasons. That children do not automatically adopt this "scientific knowledge" as their own view was demonstrated by Nussbaum (Mali and Howe, 1979; Nussbaum and Novak, 1976; Nussbaum, 1979; Nussbaum, 1985) who studied children's ideas about the earth in space.

Wittrock (1974) describes a generative learning model which attempts to explain how "scientific knowledge" becomes linked with "life-world knowledge." Wittrock's basic postulates on the possible learning process state that the learner's existing ideas influence how sensory input to the brain is used or not used; that the learner constructs meaning by linking selected input to parts of the memory store; that the learner may test constructed meaning against other aspects of the memory store, and; that to test out or subsume meanings requires individuals to accept a major responsibility for their own learning (Osborne and Wittrock, 1985).

Solomon (1983, 1984) proposed that children's thought processes operate in two domains of knowledge. These two co-existing spheres she refers to as "life-world knowledge," based on everyday experiences, and "scientific knowledge" which is based on school-centered teaching. Crossing over from one domain to the other involves an abrupt discontinuity of thought, and thus the ease of movement from one domain to another is not assured nor equal.

Thus, a student's perceptions of the world, particularly in this case the seasons, influence how he or she will construct meaning to the scientific concepts about the seasons which he or she is taught. That ideas introduced in school must in some way link to existing ones is essential. The purpose of this study, hence, is to determine what the "life-world knowledge" about seasons is for a group of fourth-grade

students and to attempt to relate this knowledge to their "scientific knowledge" of the seasons. The question then becomes, what is the best way to collect children's concepts of the seasons? For this study, three different interview techniques were used to collect children's conceptions of the seasons: the repertory grid, draw and describe, and the interview-about-events/instances.

Three Techniques for Collecting Children's Concepts

The Repertory Grid. The repertory grid technique evolved from George Kelly's Personal Construct Theory (1955). Kelly is frequently considered the "father" of the constructionist movement because his Personal Construct Theory has been the basis of much of today's science education research (Driver and Oldham, 1986; Pines and West, 1986; Solomon, 1984; Pope and Gilbert, 1983).

Kelly's original technique, called the Role Construct Repertory Test, was used to investigate and assess the role of relationships between patients and their families, friends, etcetera. For Kelly, a construct (in this study a season) was a dimension which evolved from a particular set of elements (social, cultural or scientific variables related to the seasons) and could usually be applied to a further range of elements. The dimensionality of a construct allowed one to extract matrices (grids) of inter-relationships between constructs and between elements. Originally elements or constructs of the grid may or may not have been provided for the interviewee depending on the kind of information to be elicited. When constructs or elements were not provided by the interviewer, they were elicited by using a triad approach (Pope, 1980). In this study the triad was formed by one season being compared to two others.

Draw and Describe. The study and analysis of children's drawings dates to 1885 when Cooke and other pioneer child psychologists were instrumental in identifying developmental stages in children's spontaneous drawings (Goodenough, 1926). The modern study is best characterized by Goodenough's "Draw a Man" approach to intelligence testing of elementary school children (1926). Today, this procedure is called the "Goodenough-Harris Draw a Person" test and has been standardized as two scales, i.e., the "Draw a Man" (DAM) scale and the "Draw a Woman" (DAW) scale (Harris, 1963). The "Draw a Person" (DAP) test has been popular because it is non-verbal and requires only rudimentary language to administer. Buck (1948) extended its use to "House, Tree, Person" test. Dennis (1966) has also used DAP for evaluating group attitudes and values.

The present use has been adapted from an unpublished study by Carter (1981) which entailed in-depth individual interviews with twenty children between the ages of six and sixteen. Each participant interviewed was asked to draw a summertime and a wintertime picture, and to describe what was being drawn.

Interview-About-Events/Instances. The interview-about-events approach and the closely related interview-about-instances were both developed by Osborne (1980) and Osborne and Gilbert (1980). Both techniques place emphasis on eliciting children's ideas of phenomena

however unscientific these may be. The interview-about-instances focuses primarily on exploring the concepts which a child associates with a particular word. The interview-about-events is a more flexible interview procedure and is used to investigate children's views of everyday phenomena. The interview-about-events approach uses line drawings on cards representing situations which embody scientific concepts. The interview situation allows children to ask questions about the subject matter to clarify perceived or actual ambiguities before responding to questions.

A comparison of the similarities and differences among the three techniques is provided in Table 1. One of the most important is the relationship of the techniques to school and classroom activities. The Repertory Grid is not similar to classroom activities and may be more uncomfortable to the children than the Draw and Describe or Interview-About Instances which are more closely related to "normal" classroom activities.

Insert Table 1 about here

Results: Repertory Grid

The triad format allowed for elicitation of ten elements, but only six commonly mentioned. These elements (with their "opposites") were rainiest/least rainy, snowiest/least snowy, sunniest/least sunny, windiest/least windy, hottest/coldest, and most leaves on trees/least leaves on trees.

The children were in agreement on the ranking of the seasonal characteristics ninety-five percent of the time for snowfall, sunshine, temperature variations, and tree foliage categories. However, responses for rainfall and wind speed characteristics had a broader distribution. Half of the children thought that summer had the least rain while the other half thought that winter had the least. Responses were in total agreement that summer was the least windy while a majority thought that fall was the second most windy season. Only two of the seven responses felt that spring was the windiest season.

Students also listed the following elements which could be associated with various seasons: hibernation of animals, flowering of plants, location of activities and sports (outdoors versus indoors), and types of clothing worn.

Results: Draw and Describe

The results of this technique centered around activities associated with the seasons, rather than on the physical characteristics of the seasons themselves. These activities were diverse ranging from camping, roller skating, picnicking and boating, to mention a few, in the summer months, to sledding, building snowmen, or staying inside and playing games on the computer in the wintertime.

However, some seasonal characteristics were noted by children. Summertime pictures included a sun (6), green grass (5), trees with leaves (4), flowers (3), birds (3), and clouds (2); while wintertime pictures showed snow (5), snowmen (4), trees without leaves (4), and a sun (although darker, only in one). One wintertime picture also included a bird feeder from whence one might infer that birds are present in the wintertime.

Results: Interview-about-events/instances

Using this technique the most mentioned characteristics for summer were hot (6), sunny (5), leaves on the trees (4), and birds present (4). Most frequently mentioned winter characteristics were snow (7), cold (6), no leaves on the trees (6), and not much sun (3). Fall attributes were leaves falling (8), moderate temperature (6), different colored leaves (3), and windy (3). For spring the attributes most mentioned were birds (5), followed by green leaves (4), flowers (4), rain (4), and moderate temperature (4). The children categorized the relative amounts of rainfall as follows: summer had at least some rain (3), fall had rain (1) or not much rain (2), winter had no rain (1) or some rain (2), and spring had rain (4) and was damp (1). These responses tend to correspond well with those from the repertory grid.

The children's perception of cloud cover was also similar to the repertory grid responses. Summer is sunny (5) and has no clouds (1), fall is kind of sunny (3) and has some clouds (1), winter has not much sun (3) and is cloudy (2), while spring has some sun (2) and some clouds (2).

Comparison of Techniques

The repertory gird technique was most useful in delineating children's perceptions of seasonal characteristics while the draw and describe elicited responses primarily relating to seasonal activities and celebrations. The responses from the interview-about-instances corresponded well with those from the repertory grid, but also included references to seasonal activities and celebrations.

Generalizations: Children's Concepts of Seasons

The following eight items are similar to those collected by Carter (1981) and Stepans and Kuhn (1985). Only item eight indicated a scientifically correct explanation.

1. The world turns around, and we do not face the sun in the wintertime.

2. The orbit of the earth brings it closer to the sun during the summer. The earth is further away from the sun in the winter.

3. Because the earth is tilted differently, the sun hits more directly in the summer and makes the earth warmer. The earth actually leans over as it "tilts" toward the sun during the summer and "tilts" away from the sun during the winter.

4. The sun comes out more in the summer; the sun gets hotter in the

summer. There is a different sun during the summer and winter, or the sun is sometimes hot and sometimes cool.

5. The sun does not shine during the winter.

6. In the winter clouds make sleet and snow, and therefore, we have winter.

7. The earth and sun can easily stop, start or change their direction of movement or orbit.

8. The weather (climate) on earth becomes warmer as you move toward the equator. The seasons are less distinct as you move from the poles to the equator. The sun is always "overhead" at the equator.

Further Questions

Several questions have been raised by this study. The seasons and their causes are universally taught in the elementary grades. What can this study tell us about appropriate content and methods for teaching seasonal conceptualization in the elementary grades? For example, should we refrain from considering the "tilt" of the earth before a specific grade? Can we find alternative terms to describe this tilt? How can we use children's understanding that the seasons are less distinct as you move toward the equator?

Seasons are taught within many different subject matter areas in the elementary school. Does this study suggest that "scientific" concepts cannot develop without concern for children's social and cultural concepts of seasons? Does this support the current emphasis on science, technology, and society as an issue for the science curriculum?

How can we integrate the variety of findings on children's science concepts? Can one construct hierarchical levels of understanding the cause of the seasons similar to Nussbaum and Novak's hierarchical notions of the earth? Would such levels correlate with Nussbaum's and Novak's hierarchical notions and does an accurate geocentric view undergird the student's ability to understand the cause of the seasons?

TABLE 1 SUMMARY ANALYSIS OF THE THREE TECHNIQUES

REPERTORY GRID	DRAW AND DESCRIBE	INTERVIEW-ABOUT-INSTANCES
Child names the seasons	Child names the seasons	Child names the seasons
Interview is highly directed	Interview has low level of direction	Interview has moderate amount of direction
Deals with a comparison of seasons	Deals with two seasons (summer & winter)	Deals with one season at a time but comparisons are easily made
Not similar to school drawings & activities	Similar to school drawings & activities	Similar to school drawings & activities
Location specific	Open to comparison of geographic locations	Open to comparison of geographic locations
Thinking is directed	Allows for subconscious time, think over what is said and drawn	Thinking is directed
Interviewee may not be as comfortable because not familiar with technique	Interviewee feels comfortable because drawing is familiar & takes pressure off talking	Interviewee feels comfortable because drawing is familiar
Limitation in mental processes used	Frees mind to think about more and different things	Only a moderate amount of thinking used
Based on Kelly's Personal Construct Theory	Based on Goodenough-Harris Draw a Person test Related to Talk-While-Solving-Problem approach	Based on Osborne's Interview-about-Instances Interview-about Events

REFERENCES

Ault, C. R., Jr., (1983). Structured interviews and children's science conceptions. Hoosier Science Teacher, 9, 45-53.

Buck, J. (1948). The house, tree, person technique. Journal of Clinical Psychology, 4, 319-396.

Carter, J. (1981). Children's views of the seasons. For a symposium, "Children's and Teachers' Science Concepts" presented at the annual meeting of the Hoosier Association of Science Teachers, Inc., Indianapolis, IN.

Cohen, M. R. & Kagan, M. H. (1979). Where does the old moon go? Science Teacher, 46, 22-23.

Driver, R. & Easley, J. (1978). Pupils and paradigms: A review of literature related to concept development in adolescent science students. Studies in Science Education, 5, 61-84.

Driver, R. & Erickson, G. (1983). Theories-in-action: Some theoretical and empirical issues in the study of students' conceptual framework in science. Studies in Science Education, 10, 37-60.

Driver, R. & Oldham, V. (1986). The constructivist approach to curriculum development in science. Studies in Science Education, 13, 105-122.

Gilbert, J. K., Osborne, R. J. & Fensham, P. J. (1982). Children's science and its consequences for teaching. Science Education, 66 (4), 623-633.

Gilbert, J. K. & Watts, D. M. (1983). Concepts, misconceptions and alternative conceptions: Changing perspectives in science education. Studies in Science Education, 10, 61-98.

Goodenough, F. (1926). Measurement of intelligence by drawings. Yonkers: World Book.

Helm, H. (1980). Misconceptions in physics amongst South African students. Physics Education, 15, 92-105.

Kelly, G. A. (1955). The psychology of personal constructs (Vol. 1-2). New York: W. W. Norton., Inc.

Mali, G. B. & Howe, A. (1979). Development of earth and gravity concepts among Nepali children. Science Education, 63 (5), 685-691.

Novak, J. (1977). A theory of education. Ithaca: Cornell University Press.

Novak, J. (1988). Learning science and the science of learning. Studies in Science Education, 15, 77-101.

Nussbaum, J. (1979). Children's conceptions of the earth as a cosmic body: A cross-age study. Science Education, 63 (1), 83-93.

Nussbaum, J. (1985). The earth as a cosmic body. In R. Driver, E. Guesne & A. Tiberghien, (Eds.), Children's ideas in science (pp. 170-192). Philadelphia: Open University Press.

Nussbaum J. & Novak, J. (1976). An assessment of children's concepts of the earth using structured interviews. Science Education, 60 (4), 535-550.

Osborne, R. (1980). Some aspects of students' views of the world. Research in Science Education, 10, 11-18.

Osborne, R. and Freyberg, P. (1985). Learning in Science: The Implications of Children's Science. Auckland, N. Z.: Heinemann.

Osborne, R. & Gilbert, J. (1980). A method for investigation of concept understanding in science. European Journal of Science Education, 2 (3), 311-321.

Osborne, R. & Wittrock, M. C. (1983). Learning science: A generative process. Science Education, 67 (4), 489-504.

Osborne, R. & Wittrock, M. C. (1985). The generative learning model and its implications for science education. Studies in Science Education, 12, 59-87.

Pines A. L. & West, L. H. T. (1986). Conceptual understanding and science learning: An interpretation of research within a sources-of-knowledge framework. Science Education, 70 (5) 583-604.

Pope, M. L. (1980) Practical considerations in use of repertory grid techniques. A paper presented at "What is the Repertory Grid" Workshop, Brunel University Management Programme.

Pope, M. & Gilbert, J. (1983). Personal experience and the construction of knowledge in science. Science Education, 67 (2), 193-203.

Solomon, J. (1983). Learning about energy: how pupils think in two domains. European Journal of Science Education, 5 (1), 49-59.

Solomon, J. (1984) The Social Construction of Children's Knowledge and the Epistemology of Jean Piaget. A paper presented at the BERA Conference, Lancaster University.

Stepans,J. & Kuehn, C. (1985). Children's concepts of weather. Science and Children, 23 (1), 44-47.

Wittrock, M. C. (1974). Learning as a generative process. Educational Psychology, 11, 87-95.